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Poster Abstracts P1–P36

P1 A comparison of post-flap protocols in spinal cord injury

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Objective: The purpose of this original research is to compare outcomes of patients who underwent myocutaneous flap surgery at VA Puget Sound from 1994-2016. In November 2006, protocol changed from 4- to a 6-week duration; this study examined factors that influenced success or failure of the two protocols.
Design: This was a retrospective chart review of all flap procedures completed at VA Puget Sound from 1994-2016. Each case was reviewed and eliminated if it was performed on a patient without Spinal Cord Injury/Disorder (SCI/D), was not a flap (i.e primary skin closure or graft), or occurred in nonpelvic region. The primary outcome of this investigation was the number of days between surgery and the first time the patient mobilized out of bed x 2 hours with an intact surgical incision.
Participants/Methods: 185 subjects received a total of 325 relevant flap surgeries from 1994 to 2016. Chart review of each case was completed to determine the planned duration of bedrest (4- vs 6-weeks), first date of successful mobilization x 2 hours, and rate of complications such as dehiscence or operative revisions. Information about length of stay, including the surgery and recovery, was also included to assist with evaluation of the total cost of hospitalization for this procedure.
Results: Of the 325 surgeries performed, 287 were the first operation at the identified anatomical site, and 38 were surgical revisions at a prior surgical site. 172 patients were treated with the 4-week protocol and 115 with the 6-week protocol. Comparison of the two groups revealed statistical differences in percentage of subjects who a) were smokers and b) had diabetes. No significant differences in means were noted for a) operative date to 2hrs sitting, b) operative date to time of discharge, c) incisions that never healed and d) 1-year recurrence of skin breakdown. There was, however, a trend towards reduction of 1-year recurrences in the 6-week protocol.
Conclusion: The 4-week protocol achieved mobilization (at 2 hours) sooner but with a minority of patients taking longer than the 6-week protocol. In patients receiving a single surgery, hospital stay is 1-week shorter when following the 4-week protocol; however, it appears the 6-week protocol may be more successful in those patients categorized as high risk. Further analysis may reveal specific risk factors to warrant longer duration of bedrest to decrease the risk of complications and recurrences.
Support: None to disclose.

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P2 A safety study of a robotic hand device for people with cervical spinal cord injury

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Objective: Cervical spinal cord injury (SCI) causes a significant functional impairment through the loss of hand function. Rehabilitation of the impacted hand currently involves range of motion (ROM) exercises and functional electrical stimulation. A robotic system, the Function electrical stimulation (FES) Hand Glove 200 was developed with the goal to improve hand function more efficiently. Unique to this device, it provides passive range of motion (PROM) to the thumb and fingers 2-5, and simultaneous FES to corresponding muscles through surface electrodes. The safety of this device is tested in this study.
Design: This is a prospective safety study, which evaluated the occurrence of potential adverse effect associated with the use of study device.
Participants/methods: The referred candidates were screened by physicians. Participants included were aged 18-60 with traumatic spinal cord injury (SCI) at levels C4-8 and American Spinal Injury Impairment Scale (AIS) A, B, C and D. They were medically stable, and had impairments in upper extremities strength and range of motion or function, including hand. The subjects received a total of 1 hour of intervention per session for 6 weeks. Primary outcomes included skin integrity, occurrence of autonomic dysreflexia, visual analog scale for pain. Secondary outcomes included change in PROM, muscle strength and functional independence measurement.
Results: 11 of 14 subjects completed the interventional course. Skin integrity of all subjects was maintained throughout the study. One subject had elbow pain unrelated to the use of study device. No occurrence of autonomic dysreflexia was recorded during the use of FES Hand Glove. For the secondary outcomes, there were no significant decrease in active or PROM in forearm, wrist, or finger joints in any subjects equal or greater than 10 degrees. There was no loss of strength over 1 pound as measured by gross grasp, pinch tip, 3-point, or lateral grip. There was no decline in motor strength per manual muscle testing. No worsening of FIM score was noted.
Conclusion: This study supports the safety and tolerability of a 6-week course using FES Hand Glove 200 in traumatic SCI tetraplegic subjects.

P3 Accessing computers using a multimodal tongue-drive system in tetraplegia

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Objective: Tetraplegia can significantly limit a person's ability to perform activities of daily living (ADLs) and control their surrounding environment. Assistive Technologies (AT) aid persons with tetraplegia to better communicate and control their environments. The purpose of this study is to investigate the performance of an AT called multimodal Tongue Drive System (mTDS), which uses 3 different modalities simultaneously: tongue movements, head movements, and voice commands, to control a computer more efficiently.
Design: This case series presents the complete results of the first two participants that are included in an ongoing larger observational study. Study participants were asked to perform common computer tasks, such as mouse navigation, scrolling, selecting icons on the screen, typing, and drag-and-drop functions using combinations of the 3 modalities available on the mTDS. We quantified the performances in terms of speed and accuracy of the 5 tasks across all 3 sessions. The first round of each session was considered practice and remaining 3 for performance.

Participants/methods: We recruited two male participants, ages 25 and 37, with C4 ASIA A tetraplegia who are experienced computer users. They completed pre- and post-trial questionnaires. Participants were fitted with a headset, magnetic tongue tracer, and microphone. After calibration and training, the following tasks were performed: center-out tapping, maze navigation, playing a game, solving a puzzle, and sending an email. Each participant completed 3 sessions over a 2 week period.
Results: On average, we observed 63.7% improvement in throughput across sessions, while error rate decreased by 1.4% in the center-out tapping task. Path efficiency, however, dropped by 9.37%. Maze navigation throughput and accuracy of keeping the cursor inside of the path boundary were increased by 65.4% and 0.94%, respectively. The game score was improved by 76.3%. Drag and drop ability, in which head and tongue movements are used simultaneously, increased by 150%. Speed at preparing and sending an email with randomized text also increased by 30.9%.
Conclusion: Users were able to demonstrate rapid improvement in both accuracy and speed of accessing a computer using the mTDS. Participants' responses to pre/post-trial questionnaires indicate that they enjoyed use of the system and they are interested in adopting it for ADL, environmental control, and mobility for future research.

P4 Augmenting exercise capacity with non-invasive ventilation in high-level spinal cord injury

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Background: High level spinal cord injury (SCI) results in a very limited innervated skeletal muscle mass that strongly reduces exercise capacity. Our recent work showed that when adding functional electrical stimulation (FES) of the paralyzed legs (hybrid FES exercise) to produce higher exercise capacity, peak ventilation became a limiting factor to training-induced improvement in aerobic capacity. Our assumption was that the systemic adaptations to exercise training are delimited by the maximal ventilation that can be achieved.
Design: Case report
Participants/methods: Herein we present a case showing an acute increase in aerobic capacity when using NIV during FES-rowing test in an individual who had previously experimented a plateau in his aerobic capacity for 18 months. An 18-year-old male with C5 SCI trained with arms-only rowing for 6 months and subsequently trained with hybrid FES-rowing for 18 months. VEpeak and VO_2max were increased after arms only training and increased further with 6 months of hybrid FES row training.
Results: Despite continued intense and frequent, hybrid FES-row training, neither VEpeak nor VO_2max increased further over the next year (1.94 L/min and 66.0 L/min). However, when this individual performed a FES-rowing VO_2 max test with the addition of NIV, VEpeak increased by 5 L/min resulting in an improved VO_2max (2.23 L/min, +12%).
Conclusion: This case demonstrates that non-invasive ventilation can overcome limitations to ventilation in high level SCI and improve aerobic capacity during hybrid FES-exercise to a level not otherwise achievable. In addition, it broadly illustrates the intimate role of pulmonary function in determining the capacity to perform exercise.

P5 Autonomic dysreflexia in an individual with spina bifida during urodynamic evaluation: A case report

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Objective: Autonomic dysreflexia (AD) can occur in up to 85 percent of individuals with spinal cord injuries above the 6th thoracic (T6) level. This is the first documented case that we are aware of demonstrating an individual with spina bifida who develops AD during urodynamic evaluation. The objective of this case is to increase awareness of the risk of AD in those with spina bifida.
Design: Case study.
Participants/methods: In 2009, a 43-year-old male with history of thoracic spina bifida joined our clinic for management of his neurogenic bladder. Since then, he has followed up at least yearly for a water fill urodynamic evaluation with a fill rate of 50 ml/min. He manages his bladder with an indwelling urethral catheter that is changed monthly. He currently takes oxybutynin 5 mg by mouth 4x/day. He does not take any medications that elevate his blood pressure.
Results: Over the past 10 years, the patient's average baseline systolic blood pressure was 98.3 (standard deviation (STD) 20.0) mmHg. During urodynamic evaluation, his blood pressure increased to an average of 152.2 (STD 11.6) mmHg. The average increase in his blood pressure was 53.8 (STD 24.0) mmHg, which met criteria for AD. The patient occasionally reported that he felt dysreflexic when his blood pressure was elevated. However, the majority of time the patient was asymptomatic and unaware of his AD (silent AD).
Conclusion: This case demonstrates individuals with congenital spinal cord dysfunction, such as spina bifida, may also be at risk for AD. Persons with higher level of spinal defects or dysfunction would benefit from blood pressure monitoring for AD.

P6 Biomechanical analysis of wheelchair athletes with paraplegia during cross-training exercises

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Objective: To quantify shoulder joint kinematics of novice, intermediate, and experienced wheelchair athletes during cross-training exercises.
Design: Observational study
Participants/methods: Three male wheelchair athletes, average age of 37.1 ± 4.6 years, with spinal cord injury levels of T8, L2, and T10, were novice, intermediate, and experienced with cross-training, respectively. Motion capture was performed during multiple trials of three cross-training exercises: battle rope, sled pull, and overhead press. Our custom upper extremity kinematic model was applied to determine three-dimensional joint angles. A ten-repetition average was calculated per subject for each exercise.
Results: Moving from novice to intermediate to experienced athlete during the overhead press exercise, there was a trend towards increased peak elevation angle (95.6°, 153.0°, and 171.4°) resulting in increased ROM. The experienced athlete had the least amount of internal rotation when the weight was at peak height. The battle rope exercise trended towards increased peak flexion (71.2°, 93.7°, and 99.9°), increased axial rotation ROM (16.5°, 19.9°, and 27.0°) and adduction (-8.9°, -8.6°, and 5.9°). The sled pull exercise trended towards increased abduction (−33.1°, −42.4°, and −54.9°). Additionally, multiple parameters demonstrated differences among the athletes, including sagittal plane ROM (56.8°, 79.5°, and 41.4°) and peak internal rotation (49.7°, 42.0°, and 70.4°).
Conclusion: During cross-training exercises, shoulder joint kinematics of wheelchair athletes vary with experience. These findings may help to reduce or prevent injury through improved guidelines for prescription of sports activity and proper technique. Research is underway to characterize the thorax and comprehensive upper extremity joint kinematics and determine the influence of spinal cord injury level on performance during cross-training exercises.
Support: We thank the Medical College of Wisconsin Research Affairs Committee and the study's certified personal trainer, Justin Plesnik.

P7 Center for Spinal Cord Injury improves access to health care

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Background: As shown by Krause, DeVivo, & Jackson, 2011, the spinal cord injury (SCI) population is often underserved which can impact life expectancy. Additionally, the SCI population frequently has difficulty accessing and receiving the appropriate care in the post-acute care setting. The Center for Spinal Cord Injury (CSCI) at Roper Hospital operates as a multidisciplinary approach to manage the care of patients with Spinal Cord Injury in South Carolina. Many of these patients are underfunded or receive their care through South Carolina Medicaid. CSCI is tasked with screening, monitoring, and addressing their functional, medical, and social needs.
Participants/methods: Twice a month the CSCI meets and provides evaluations by a team consisting of Registered Nursing, Occupational Therapy, Physical Therapy, Seating Specialists, Recreation Therapy, Social Work, Behavioral Counseling, and a SCI Physician. The staff uses a variety of outcome measures including Modified Ashworth Scale, Spinal Cord Independence Measure, Braden scale, diagnostic labs, as well as a history from the patient on how they function in their environment to capture a snapshot of their current status. These screens are repeated on subsequent visits to monitor progress over time. The CSCI fills a void for many SCI patients that are newly diagnosed or have been living with SCI for years.
Conclusion: CSCI has been instrumental in the early diagnosis and treatment of common medical complications in the SCI population. This comprehensive access to care in the SCI population has positively impacted patients.

P8 Changes in pressure distribution during exoskeleton use in paraplegic male

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Objective: To compare pressure distribution during robotic exoskeleton use to pressure distribution during normal daily activities for a paraplegic male Veteran.
Design: A within subject comparison of pressure mapping data taken at different times during the use of the ReWalk 6.0 Exoskeleton including seated in the device, immediately upon standing, during ambulation, standing after ambulation and return to sit. Pressure distributions were recorded during static sitting in patient normal wheelchair, as well as seated in a chair for comparison. All pressure mapping was completed for one participant, in the same day, with the participate wearing the same clothing, using the XSensor PX100 pressure mapping system.
Participants/methods: 35-year-old male Marine Veteran with T8 ASIA B spinal cord injury as a result of a motocross accident in 2010. Patient has no past medical history of pressure ulcers. The patient uses a Panthera ultra-lite rigid frame wheelchair with foam cushion for normal daily activities.
Results: During static sitting in wheelchair the results indicate increased pressure over the ischial tuberosities. These areas of high pressure, 149.3 mmHg and higher, increased dramatically during static sitting in a standard chair, increasing distribution to medial glutes, and when seated in the exoskeleton increasing distribution to pelvic band and lower back. Pressure mapping data indicates a complete shift in pressure distribution to include only high pressure at the upper sacral region, directly between the user and the pelvic band, during standing and walking in the robotic exoskeleton.
Conclusion: Pressure mapping data indicates that areas of increased pressure during static sitting activities are completely offloaded during standing and walking in the robotic exoskeleton. This indicates that exoskeleton assisted mobility is effective in eliminating pressure at ischial tuberosities, proximal hamstring tendons and the glutes, areas at high risk of pressure sores in individuals with spinal cord injury. The change in pressure

distribution to upper sacral region during exoskeleton assisted walking supports the need for skin checks that focus on the specific areas of pressure seen when using the exoskeleton device.
Support: Cooperative Studies Program #2003 Exoskeleton Assisted-Walking in Persons With SCI: Impact on Quality of Life.

P9 Diagnosis and treatment of chronic autonomic dysreflexia from lumbar stenosis

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Objective: Autonomic dysreflexia (AD) is a well-known complication in those with spinal cord injury (SCI) at T6 or above. It is caused by any noxious stimuli below the level of injury. 80% of cases are due to bladder irritation, 15% due to fecal impaction, and a long list of possible triggers make up the remaining 5% of causes. Here we present a case of chronic AD due to lumbar stenosis with resolution following spinal intervention.
Design: Case report of unique case describing diagnosis and treatment of AD in a chronic SCI patient.
Participants/methods: 58-year-old female with history of C4 incomplete SCI after pedestrian versus car at age two. She presented with two years of chronic AD and nonspecific back pain treated with fentanyl and oxycodone. PMH of T3 to L4 fusion at age 13, urostomy and ileoconduit, bowel care with digital stimulation. Typical AD work-up as well as abdominal CT, cholecystectomy and lithotripsy completed in attempt to determine cause of AD. Symptoms occurred daily and were positional when upright with a blood pressure up to 240/110. It prevented employment and she spent most of her time supine. Lumbar MRI revealed severe lumbar central stenosis and severe lumbar facet joint arthropathy at L3-L4 and L4-L5. She also had facet joint effusions concerning for Charcot Arthropathy and likely instability at L4-5 and L5-S1. She underwent two facet block procedures, both leading to immediate post procedure AD and no improvement in her pain. Two subsequent lumbar epidural steroid injections (ESIs) provided more than 90% relief of her pain and resolved her AD for ten days with each procedure. She then underwent L4-L5 interlaminar decompression with complete resolution of AD and discontinuation of opiates and return to previous activity including work, volunteering and physical therapy.
Results: Identified lumbar stenosis as a less common cause of AD along with treatment options for resolution. We demonstrate a work-up with a series of spinal injections to aid diagnosis and increase confidence in surgical intervention.
Conclusion: Pain is common following SCI and below the level of injury may present as AD. Our patient had complete resolution of pain and AD with lumbar interlaminar decompression. A series of interventional spinal injections including intra-articular facet blocks, medial branch blocks and ESIs helped to identify the lumbar structure causing her pain and increased confidence in surgical intervention.

P10 Difficult families + difficult decisions = difficult discharge planning and moral distress

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Objective: To identify the types of decisions that are encountered when planning for discharge in SCI/D. Such decisions can impede the discharge process, particularly with patients and families who are resistant to discharge to the home or an alternative placement. (NLASW 2015) Consequently, these decisions can result

in prolonged stays in an acute medical setting when the Veteran could be cared for in a less acute medical setting, incurring significant costs for the Veterans Health Administration.
Design: Case studies.
Participants/methods: The discharge planner works with the SCI treatment team and patients to identify and anticipate barriers to discharge, (Levin 2015) including complex family dynamics and personality factors (Rexvid, Evertsson, Forssen & Nygren, 2014). Case studies illustrate how the SCI team, the Veteran and the Veteran's family are hampered by (covert) resistance that impedes the decision-making process. Such resistance can derail discharge plans and cause moral distress. Other decision-making processes involve deciphering the values, utilities and goals of the decision-maker, to include personal and family ethics as well as self-determination. Discharge planning begins on the first day of admission to the VA Spinal Cord Injury Center. As members of a multidisciplinary team, we work with patients and their support system to accomplish the goal of a successful discharge, wherein safety and medical care needs are met. There are many decisions along the way that can support or hamper the discharge process and impact how successful the discharge will be. (Swidler, Seastrum & Shelton 2007, Hill. J, Filer W, 2015). Veterans sometimes present unique challenges to the discharge planning process due to complex personality and family dynamics, paired with the nuances of the VA SCI system of care.
Conclusion: Decision-making in discharge planning is a culmination of options, usually presented by the SCI team to the Veteran and the Veteran's support system. Discussing barriers encountered during the discharge decision-making process, and how they can be addressed, can potentially facilitate more efficient and effective discharge planning if applied to other cases that providers encounter in their own practice.

P11 Effectiveness of penile injection therapy in spinal cord injured males

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Objective: To determine the effectiveness of penile injection on erectile dysfunction and sexual satisfaction in spinal cord injured males.
Design: SCI injured males with erectile dysfunction that did not respond well to PDE5 inhibitors or other interventions were referred for evaluation of the appropriateness of penile injection. An educational clinic visit was completed at which time the patient was educated on all interventions that may be appropriate, including constriction bands, VED, PDE5 inhibitors, injection therapy and surgically implanted prosthesis. If they were deemed to be an appropriate injection candidate the patient returned for an initial injection in the clinic of either alprostadil only or TriMix (10/.2/30) after consent and further education was completed. Prior to injection, a SHIM questionnaire was also completed. The patient then completed further injections independently with titration guidance from the nurse practitioner. After titration a follow-up SHIM questionnaire was completed.
Participants: 21 men with spinal cord injury of varying levels underwent the injection procedure.
Results: Of the participants who completed the post-injection survey, there was only one patient who had no improvement with the injection. This patient moved states during the study and did not complete titration to completion. Of the remaining participants who completed the post-injection survey, the average pre-injection SHIM total score was 7.15. The average post-injection SHIM total score was 18, with an average increase of 10.87 points. In the sexual satisfaction score, the average pre-injection score was 1.62. The average post-injection score was 3.86, with an average increase of 1.84 points.
Conclusion: Penile injection is a clinically effective intervention for improving both erectile dysfunction and sexual satisfaction in spinal cord injured males.

P12 Examining impact of travel barriers and facilitators on travel participation

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Objective: This research investigates the inter-relationships among environmental factors, personal psychological factors and participation of individuals living with spinal cord injury (SCI) in the travel context. Specifically, the study tests a set of hypotheses that depict the relationships among barriers to and facilitators of travel participation, travel needs satisfaction, travel motivation, and travel participation. The hypotheses are developed based on the Self-Determination Theory.
Design: Study reported here is a part of a larger project which adopts a mixed-method approach in examining the impact of environmental factors on participation. Scales of travel barriers and facilitators were derived from qualitative interviews and then tested using item-response theory based Rasch analysis. Quantitative data were collected to test the scales and hypothesis.
Participants/methods: To test the hypotheses, a total of 250 surveys were collected from patients enrolled in Rocky Mountain Regional Spinal Injury System, who were due for the routine anniversary Form II telephone interview from February 2016 to March 2017. Path analysis was conducted in Amos 24.0 to test the hypotheses depicted in the study's model. Bootstrap analysis with 2,000 samples at the 95% bias-corrected bootstrap confidence level was performed on the non-normal data.
Results: Overall, the model has a good fit to data ($\lambda 2 = 19.9$, df = 12, p = .07; CF = .99, TLI = .96, GFI = .98, AGFI = .93, NFI = .97, RMSEA = .05). Results show that travel barriers and facilitators have a significant positive relationship; that is, the more barriers a person encounters during travel, the more helpful the person perceives a travel facilitator (e.g. travel tips shared by other people with SCI). In addition, travel barriers explains 47% of the variance in travel facilitators. Travel barriers and facilitators negatively impact respondents' needs for autonomy, explaining 10% of its variance. The barriers and facilitators also influence respondents' introjected motive (e.g. feel like a failure if I haven't traveled for a while) and external motive (e.g. feel under pressure from friends/family to travel) for travel, which in turn leads to travel participation. Impact of environmental barriers and facilitators on participation is minimal.
Support: Craig H. Neilsen Foundation (Project #321788).

P13 FDA exoskeletal-assisted walking velocity: Who can get there?

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Background: Clinical exoskeletal-assisted walking (EAW) programs have been established throughout the country. There are many unknown challenges to set up these programs such as: addressing staffing needs; determining the number of sessions to achieve the walking velocity milestone for ambulation; and the FDA criteria for personal use prescription in the home and community with these devices. The purpose of this study was to determine the proportion of participants who achieved successful EAW velocities at 12 and 36 sessions.
Design: A three-site, multi-center, on-going interventional study in participants ≥6 months post SCI is being performed.

Participants/methods: To date, 29 participants completed 36 sessions of EAW training, three sessions per week (4-6 h/week) in a 12-week period. The 10 meter walk test (seconds) (10MWT), 6-minute walk test (meters) (6minWT), and the timed-up-and-go (seconds) (TUG) are reported at 12 and 36 sessions. A nominal velocity and distance milestones of 0.25 m/s (VN) for 10MWT and at least 90 m (DN) in 6 min were chosen by other studies [1] as a minimal safe speed of ambulation. For personal use prescription, the FDA requires 0.40 m/s (VFDA) and 110 m (DFDA).
Results: The mean age and duration of injury of all participants were 40 ± 14 years and 4 ± 4 years, respectively. By 12 sessions: for the 10MWT, 16 of 29 (55%) participants succeeded VN and 5 (17%) achieved VFDA; 12 (41%) accomplished DN and 6 (21%) DFDA; 20 participants (69%) performed the TUG test in <90s. By 36 sessions: 22 (76%) accomplished VN and 8 (28%) VFDA; for the 6minWT, 22 (76%) accomplished DN and 19 (66%) DFDA; and the TUG had 20 (69%) participants in <90s.
Conclusion: More than one-half of the participants achieved VN and less than one-fifth, achieved VFDA by 12 sessions, the proportion of participants to achieve these same goals were greater by 36 sessions. It may not be practical for clinicians to provide 36 sessions of EAW training. Therefore, when personal prescription is the goal, an EAW basic mobility skills screening test should be developed to identify those participants most likely to achieve FDA skill criteria in a feasible number of sessions as per the resources of the clinic setting and the availability of the client.
Support: Department of Defense/CDMRP SC130234 Award: W81XWH-14-2-0170 and National Center for the Medical Consequences of SCI (B9212-C, B2020-C) at the James J. Peters Veterans Affairs Medical Center.

P14 Fibrocartilaginous emboli: An uncommon cause of spinal cord infarction

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Objective: To describe a case of spinal cord infarction in an otherwise healthy individual that was suspected to be from fibrocartilaginous embolism.
Background: Fibrocartilaginous embolism (FCE) is a rare cause of spinal cord infarction in humans. In FCE, the spinal cord infarction is postulated to result from migration of fibrocartilaginous nucleus pulposus material through the nearby vasculature into one of the spinal cord vessels. This was first described in 1961 and since, several cases have been reported to cause infarction of the spinal cord, lung, brain, vertebrae, and ribs.
Participants/methods: A 20 year-old left-hand dominant male was playing volleyball with friends when he reportedly experienced sharp pain on the right side of the neck after turning his head. He subsequently developed right arm weakness/numbness. He was taken to local ED by his friends and upon arrival, he could no longer move his arms or legs. In the ED, he started having difficulty breathing and was intubated. Initial imaging studies including CTA brain and neck were negative. Subsequent MRI of brain reportedly demonstrated multiple acute to subacute posterior circulation lacunar infarctions involving bilateral cerebellar hemispheres, bilateral medial thalami and parasagittals, and right parietal cortex. MRI cervical spine reportedly demonstrated cervical spinal cord hyperintensity, concerning for inflammatory vs ischemic myelopathy. Acute hospital course was significant for prolonged respiratory failure necessitating tracheostomy/PEG placement, and intermittent fevers. He was eventually medically stabilized and transferred to Shepherd Center for comprehensive rehabilitation. On admission to Shepherd Center, neurological testing was consistent with C2 AIS A SCI with sensory ZPP to L5 on the right and S1 on the left. At discharge, repeat ASIA exam was consistent with C1 AIS C SCI.
Significance for SCI practice: There are a multitude of etiologies of non-traumatic spinal cord injuries. More commonly, infections, inflammatory conditions, demyelinating diseases, compressive/mass lesions, congenital diseases, and vascular disorders. More rare causes of spinal cord injury/infarction (such as FCE) should be considered if one of the more common etiologies is not identified.
Conclusion: In an otherwise healthy individual who experiences a non-traumatic spinal cord injury, one should consider FCE as a potential cause.

P15 Functional benefits of lower extremity prostheses in tetraplegia and paraplegia

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Objective: To describe the functional benefits of prostheses in spinal cord injury (SCI) even in the setting of residual limb paralysis.
Design: This case series describes two patients with SCI and prostheses for unilateral lower extremity amputation. The individuals' medical charts were reviewed, and their clinical progression, and functional outcomes will be discussed. A literature search was conducted using PubMed.
Participants/methods: Two cases of patients with SCI are described: one with paraparesis who sustained a concurrent short transfemoral amputation at the time of SCI, and one with tetraparesis who later underwent a transtibial amputation due to subsequent complications after SCI. Charts were reviewed and a literature search was conducted to assess the latest evidence, current practices, documented case reports and potential functional benefits in this unique population.
Results: The literature review conducted in this study revealed that for the past three decades, there have been very limited primary research studies and only very few case reports describing this particular population. Both patients described in this case report maintained or improved function after receiving their respective prosthesis. The individual with paraparesis and simultaneous short transfemoral amputation experienced improved sitting balance, posture and mobility. The individual with tetraplegia and subsequent transtibial amputation regained transfer ability using his prosthesis and was able to resume use of rehabilitation equipment such as a stander and a functional electrical stimulation (FES) bike. Both individuals have been able to return to aggressive SCI therapy. Neither individual has experienced residual limb skin complications associated with these prostheses despite being insensate.
Conclusion: Individuals with SCI and lower extremity amputation can benefit from the use of prostheses and should be considered for these devices. They display clinical characteristics different from either population alone. The individuals described herein improved or maintained posture and balance, resumed lower-extremity weight-bearing, and returned to participation in functional activities and rehabilitation therapies. The continued study of this population is important due to the paucity of current literature describing this population and the many recent technological advances in the realm of traditional prosthetics.

P16 Influence of body mass index in the functional independence measures change after spinal surgery for myelopathy

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Background: Functional Independence Measure (FIM) is a clinical tool used to assess an individual's physical and cognitive abilities, focusing on the ability to care for oneself. It is not known how obesity influences FIM in patients with myelopathy, after spinal surgery.
Objective: To study the influence of body mass index (BMI) on the Functional Independence Measure (FIM) scores after spinal surgical procedures to treat myelopathy due to spinal stenosis on admission to and discharge from an inpatient rehabilitation facility (IRF).
Design: Retrospective electronic chart review
Participants/methods: patients with myelopathy due to spinal stenosis who have undergone spinal surgical procedures and were admitted to an IRF. Patients were divided in 2 groups: obese patient (OP) with BMI greater than or equal to 30.0 kg/m2, versus non-obese patient (NOP). Variables included motor, cognitive,

and ADL FIM scores at admission and discharge, length of stay at the IRF, FIM efficiency, gait distances at discharge, and BMI.
Results: We analyzed 37 patients (15 OP, 22 NOP). Admission FIM scores between OP and NOP were similar, except for admission bowel management. The results of this study show trends suggesting greater improvement in FIM scores for NOP than for OP. Total FIM changes were greater for NOP (25.8 ± 2.5, mean ± SE) than for OP (23.7 ± 2.5). NOP changes in motor FIM score (8.7 ± 0.9) and gait distance (203.8 ± 30.4), were greater than OP changes in motor FIM score (6.7 ± 0.9) and gait distance (111.1 ± 30.8). There were no statistically significant changes except for the change in bowel management FIM score ($p = .013$). Higher BMI scores show the trend of lower motor FIM score change and lower motor FIM efficiency. This trend was not appreciated for cognitive and ADL FIM scores.
Conclusion: NOP improved in total FIM score change, motor FIM score change, motor FIM efficiency, and gait distance more than OP in rehabilitation admissions after spinal surgery. Further investigation is warranted to design better strategies to improve rehabilitation in OP.

P17 Interim results of Project Workout on Wheels internet intervention

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Objective: To present interim results of an ongoing RCT that examines the effectiveness of virtual online platform to promote exercise adoption over 4 months and maintenance over 2 additional months among people living with SCI.
Design: Randomized controlled trial
Participants/methods: Study participants are given access to a website that contains weekly modules that teach behavioral skills to promote behavior change and provide exercise resources and are also invited to participate in weekly, group-based virtual meetings. Participants received Polar activity trackers with a heart rate monitor and were encouraged to sync their watch to track their progress.
Results: Interim results after randomizing 49 people, 20 of whom have completed the 16-week experimental program reveal that 80% set formal exercise goals and 65% update their goals two months later. Participants initial exercise goals included plans to engage in an average of 4.5 days a week of aerobic activity for an average of 144.7 minutes each week. Participant updated goals at week 11 reveal that participants increased their planned aerobic exercise time an average of 26.8 minutes per week for an average of 174.7 total weekly minutes. Their goals show that most planned to work out at home (68.8%) and half also planned on going to the gym (50%). Seventy-five percent of the sample completed the online activity that had them anticipate potential barriers and develop plans to get back on track. Common barriers included work, health events, lack of sleep and energy. Sixty-five percent synced their Polar data and the data indicated participants engaged in an average of 42 minutes per week at an average heart rate of 125 beats per minute. Study retention to date over 16 weeks is 79%.
Conclusion: This study is heavily reliant on technology and despite all participants having their own internet connected computer, tablet, or smartphone, technology use has created numerous challenges for participants and intervention delivery that require being addressed in real time.
Support: The contents were developed under a grant from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR grant number 90IF0091-01-00).

P18 Intrathecal baclofen for spasticity management: A case study

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Objective: To describe the process of transitioning from oral baclofen to intrathecal baclofen (ITB) via implanted Medtronic Synchromed II pump in a goal-directed manner.
Background: Spasticity is common following an upper motor neuron injury. It can make movement difficult and contribute to discomfort, muscle spasms, and the formation of pressure injuries and contractures. It can greatly impact activities of daily living such as feeding, toileting, dressing, positioning and sleeping.
Design: Case study
Participants/methods: 54-year-old male with C5 AIS C incomplete traumatic spinal cord injury with severe spasticity. Treatment was tailored to spasticity related goals identified. 50 mcg ITB test dosing occurred with significant reduction in tone based on range of motion, Modified Ashworth Scale, and verbal patient feedback within two hours. The ITB pump was implanted and individualized care with an extended hospital stay was required to wean patient from oral spasticity and pain medications.
Results: The patient's goals were met. These included spasticity control to aid with seating, ADL's, sleep and comfort as well as improvement in cognition and decreased sedation. This was ultimately reflected in a better quality of life for this client. No complications were reported.
Conclusion: Setting clear patient specific, realistic, goals for ITB therapy is essential in deciding its effectiveness. Close monitoring in the immediate post implant period is required to assess pain, spasticity, sedation, and wean patient from oral medications to prepare for transition to home. ITB route decreases systemic side effects often associated with oral antispasmodic medications and may improve quality of life.

P19 Motivating factors: A prospective look at decision-making for upper extremity nerve transfers

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Objective: To investigate the knowledge, factors and motivations of people with cervical spinal cord injury (SCI) in regard to seeking out and deciding on upper extremity (UE) nerve transfer surgery to improve hand function.
Design: In this prospective cohort study, preoperative interviews were performed. Questions addressed knowledge about procedures, motivation for UE nerve transfers, and factors contributing to decision to undergo surgery.
Participants/methods: Six subjects were interviewed using a semi-structured interview guide. These interviews were audio recorded, transcribed verbatim, and de-identified for standard qualitative text analysis.
Results: For 5/6 subjects, the SCI physician or SCI team member such as a therapist were the primary point of introduction to the nerve transfer procedure. For the remaining patient, the information was personally sought out on the internet. Factors discussed by the 6 patients included downtime from surgery, extent/ intensity of therapy after surgery, risk of change in their current functional status, time for recovery, and type of recovery after procedure. Motivations for pursuing the surgery were highly individual and included the following: a desire "to make coffee without burning myself," changing one's own colostomy bag, and ability to shake hands.
Conclusion: "The greatest potential for improvement of quality of life lies in rehabilitation and maximal restoration of upper extremity function"- Robert Waters [1]. In order to maximize the restorative potential of the upper extremities, surgical intervention must be included in the discussion. We found that the majority are obtaining information about procedures through their SCI healthcare professionals, therefore education of the patient's healthcare team is imperative to the introduction and understanding of potential opportunities for cervical SCI patients. This education/understanding should include the factors should include the factors participants voiced as contributing to their decision." Motivating factors for surgery were incredibly individualized and personal, which is similar to the approach many take to therapy and rehabilitation itself and should be incorporated into surgical decision making.
Support: Craig H. Neilsen Foundation Spinal Cord Injury Research on the Translation Spectrum (SCIRTS) grant entitled: Nerve Transfers to Restore Hand Function in Cervical Spinal Cord Injury

P20 Multidisciplinary approach to Guillain-Barre Syndrome and neurologic injuries after zika virus

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Objective: To describe the multidisciplinary approach required to provide optimal rehabilitation and medical care to a patient with Guillain-Barré Syndrome (GBS) and associated non-traumatic SCI with functional tetraplegia after Zika Virus
Design: Case report
Participants/methods: Presentation of the chronic complex rehabilitation needs for a man with Zika Virus and acquired Guillain-Barré Syndrome with course further complicated by respiratory insufficiency, cardiac event and anoxic brain injury. Clinical evaluation, review of EMR and discussion of rehabilitation and medical needs with involved providers.
Results: This case presents the chronic neurologic sequelae and complex rehabilitation needs for a patient previously infected with Zika virus. This man was referred to rehabilitation medicine clinic as part of an established multidisciplinary protocol to prepare patients with stage IV pressure injuries for flap surgery. Previously living on the island of St Maarten, all past medical records for this patient were destroyed during Hurricane Irma and in the wake of that storm, this patient and his family moved locally. Per report, this patient acquired Zika virus before also acquiring Guillain-Barré syndrome, resulting in functional tetraplegia. He suffered an anoxic brain injury related to cardiac issues from his respiratory insufficiency at time of infection as well. His current clinical presentation warranted outpatient medical referral to multiple medical services including pulmonary, neurology and orthopedics. A complex, interdisciplinary rehabilitation strategy was used to prepare for the flap surgery as well as to optimize his functional status, with PT, OT and speech therapy all involved. SLP needs were especially unique for evaluating ongoing dysphagia but also need for advanced assistive technology due to his complex communication impairments. Social work identified this patient's veteran status and helped work toward transitioning this patient to the VA system of care as possible.
Conclusion: The neurologic sequelae after infection with Zika virus are not well documented in the literature and the associated ehabilitation needs have no presence in our current literature. Reported cases of Zika virus increased in 2016 and is still an ongoing concern. With the relative timing of increased cases of Zika virus, more people previously infected and with functional impairments may present to rehabilitation clinics in the near future.

P21 Neurostimulant medications improve excessive daytime sleepiness in spinal cord injury patients

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Objective: To assess how excessive daytime sleepiness (EDS) affects patient-perceived quality of life for patients with Spinal Cord Injury and Disorders (SCI/D) and propose the use of neurostimulant medications (NSM) to improve EDS.
Design: Retrospective electronic chart review of 4 patients with spinal cord injury and disorders (SCI/D) and EDS.
Participants/methods: Four patients with SCI/D were diagnosed with EDS using Ullanlinna Narcolepsy Scale (UNS), Epworth Sleepiness Scale (ESS), and Fatigue Severity Scale (FSS). Each patient underwent medical reconciliation to identify sedating medications and medical co-morbidities that could contribute to somnolence. NSM (Adderal and Ritalin) were offered to each patient and the same questionnaires were used

to evaluate response following NSM use. Patients were also interviewed for side effects and adherence to NSM use.
Results: Three patients received Adderall and 1 Ritalin (dose was titrated to obtain EDS control). The average age was 50 years (SD ± 7.5), 2 female and 2 male, taking 5 or 6 drugs that have somnolence as a side effect (baclofen, pregabalin and benzodiazepines). Three patients did not want to have a baclofen pump placed and one is pending pump placement. Three patients were diagnosed with sleep apnea and were using BiPAP (n = 1) or CPAP (n = 2). None of the patients had EDS causing co-morbidity (anemia, hypothyroidism, depression, hepatic or renal failure). There was an improvement in EDS reflected by change in UNS (mean ± SE, −4.25 ± 4.6), ESS (−0.75 ± 2.3), and FSS (−24 ± 5.6). Anxiety was the only side-effect reported in subject #1 receiving Adderall. All patients reported that they were unable to interrupt NSM use due to EDS.
Conclusion: EDS is common in patients with SCI/D as they require multiple agents with sedating side effects. Baclofen pump placement is an option to minimize the number of somnolence-causing drugs, but not all patients qualify or are willing to undergo the procedure. NSM may represent an effective option to improve EDS. Other causes of EDS should be ruled out before starting treatment with NSM. Our study demonstrates that in patients without confounding co-morbidities, an NSM can have a significantly positive impact on symptoms of EDS. Therefore, NSM is an effective and well tolerated option to treat EDS associated with medications commonly used in patients with SCI/D.

P22 Outcomes after tetraplegia secondary to West Nile encephalitis: A case report

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Objective: Describe outcomes after rehabilitation for tetraplegia secondary to West Nile virus (WNV) encephalitis
Participants/methods: 54-year-old male who developed chronic respiratory failure, dysphagia, and tetraplegia secondary to WNV encephalitis.
Findings: A 54-year-old man with past medical history of hypertension presented to the emergency department after one week of fevers, flu-like symptoms and erythematous rash over his body. He then developed acute onset seizures, neuromuscular respiratory failure requiring intubation and eventual tracheostomy, and acute onset tetraplegia. Work up included lumbar puncture which demonstrated positive IgG and IgM WNV antibodies. Computed tomography (CT) of the head and magnetic resonance imaging (MRI) of the brain showed no acute abnormalities. Once medically stabilized, he was admitted for acute inpatient rehabilitation. On initial examination, patient had symmetric 2/5 strength with elbow flexion/extension and ankle dorsiflexion/plantarflexion bilaterally, but otherwise 0/5 strength, intact sensation, and hyporeflexia throughout. Patient also presented with severe oropharyngeal dysphagia requiring tube feeds and significant dysarthria and dysphonia requiring a letter board for communication.
Results: One year after intensive inpatient and outpatient rehabilitation, patient was able to stand with minimal to moderate assistance at the parallel bars, progress to two hours off mechanical ventilation daily, communicate with a two-way speaking valve verbally in 1-3 word phrases, and tolerate regular diet with thin liquids with assistance and supplemental tube feeds of three cans a day. Mechanical ventilation weaning progress was limited by respiratory reserve and autonomic instability during weaning.
Significance for SCI: Neuroinvasive cases of WNV are rare, with approximately 16,000 cases reported since 1999. Approximately two-thirds of those with paralysis remain with significant weakness in the affected limbs. This case demonstrates outcomes after intensive rehabilitation in a severe case of WNV encephalitis with tetraplegia and respiratory compromise.
Conclusion: Tetraplegia with neuromuscular respiratory failure and dysphagia is a rare complication of West Nile encephalitis which leads to significant functional impairments. Improvements in motor function and swallow function as well as ventilator-weaning can be achieved through intensive rehabilitation.

P23 Patient-controlled intrathecal baclofen boluses for the treatment of dystonia

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Objective: To describe a patient with severe dystonia successfully treated with intrathecal baclofen (ITB) dosed in patient-controlled (PC) boluses in addition to continuous basal infusion.
Design: Case study
Background: ITB pumps are programmed by the physician to provide infusion at pre-determined rates and intervals. In this patient, the pump was programmed to give a continuous basal infusion, but bolus doses were given only when triggered by a PC remote. Although not FDA approved for use with baclofen, PC intrathecal boluses are common in pain management. A literature search revealed case reports of PC ITB in multiple sclerosis, but none in the management of dystonia.
Participants/methods: A 35-year-old female with a family history of dystonia was diagnosed with gradually worsening generalized dystonia. Workup including imaging of the brain and spine, electroencephalogram and extensive labs was negative. She underwent unsuccessful treatment with steroids, plasmapheresis, immunosuppression, injections and lumbar sympathetic block. Oral baclofen, diazepam, risperidone and morphine provided only partial relief. She underwent placement of an ITB pump and was initially trialed on continuous infusion with some improvement in her dystonic episodes. Unfortunately, the episodes continued to occur daily, causing significant pain and distress. These episodes were always preceded by a sensational prodrome. Oral and intravenous abortive medications were not effective. After extensive patient education, the pump was programmed to administer abortive bolus doses of ITB when triggered by a PC remote.
Results: Prior to pump placement, the patient was having 2-5 dystonic episodes daily. She required minimal assistance for self-care and mobility. With self-administered ITB boluses, she is able to abort most dystonic episodes in the prodromal phase. Device interrogation reveals the patient triggers 1-3 boluses daily and is very rarely denied bolus dose due to lockout interval or daily maximum. She is now fully independent with all mobility and self-care.
Conclusion: Patient-controlled ITB boluses successfully treated dystonic episodes in this case. Physicians facing the problem of uncontrolled dystonia or any other episodic spasticity should consider this method when other treatments have failed. It requires patient education and close follow-up but can significantly improve function and quality of life.

P24 Pleural effusion complicating a shunt for recurrent spinal arachnoid cysts

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Background: Spinal arachnoid cysts are uncommon lesions that are frequently asymptomatic but can occasionally produce profound neurologic deficits. The first-line treatment for symptomatic cysts is laminectomy with complete cyst excision. This intervention generally leads to significant improvement or resolution of symptoms with low reported rates of recurrence. If operative treatment is unsuccessful, other treatment options include percutaneous aspiration or shunting.
Participants/methods: Here we describe a challenging case of recurrent spinal cord compression caused by thoracic arachnoid cysts refractory to standard treatment, and report a rare complication (symptomatic pleural effusion) following a cystopleural shunting procedure. The patient was a 67 year old woman with progressive myelopathy and bowel and bladder dysfunction caused by dorsal intradural thoracic arachnoid

cysts that recurred six months after a T4-T8 laminectomy with cyst excision. The patient underwent T2-T10 redo laminectomy and was subsequently admitted to an inpatient rehabilitation program where her condition was classified as T7 AIS D paraplegia. She showed improvements in function, mobility, and lower extremity strength and was beginning to ambulate using bilateral ankle-foot orthoses. However, five weeks into her rehabilitation program she experienced a precipitous decline in lower extremity strength and a marked increase in spasticity. MRI revealed reaccumulation of the thoracic cysts. Surgeons re-explored her previous thoracic laminectomy site and decided to insert a bilateral subarachnoid-to-right pleural space shunt for long term drainage of the fluid collections. Soon after her return to the rehabilitation unit the patient clinically declined again, experiencing episodes of severe headache, flushing, subcostal discomfort and shortness of breath. Imaging revealed a right pleural effusion, raising concern for shunt overdrainage. The patient underwent a revision of the shunt with insertion of an anti-siphon device and rerouting of the distal catheter from the pleural space to the peritoneal space. The patient did well following the shunt revision and was able to complete her inpatient rehabilitation program.
Conclusion: It is important to consider pleural effusion as a possible complication of CSF shunting procedures because early physician consideration and detection can prevent the development of serious and potentially life-threatening medical complications such as autonomic dysreflexia.

P25 Posterior cord syndrome following seroma formation after laminectomy for stenosis

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Objective: To describe a unique presentation of posterior cord syndrome following a large seroma formation after laminectomy for spinal stenosis.
Design: Case presentation.
Participants/methods: A patient developed ataxia following laminectomy with functional decline. Examination revealed loss of vibration and proprioception in the extremities.
Results: Seromas can develop after spinal instrumentation and cause cord compression. Findings of posterior cord syndrome are not routinely tested on ASIA examination and can easily be missed.
Conclusion: Seromas are rare complication following cervical instrumentation. They can cause mass effect on the adjacent spinal cord resulting in functional changes.

P26 Posterior reversible encephalopathy syndrome from autonomic dysreflexia in acute tetraplegia

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Objective: To raise awareness of posterior reversible encephalopathy syndrome (PRES) as a rare but possible complication of autonomic dysreflexia (AD) and highlight the importance of having a high index of suspicion for PRES when neurological changes are associated with AD.
Background: Individuals with SCI levels T6 and above are at greatest risk for autonomic dysreflexia (AD). A hallmark of AD is elevated blood pressure. A potential complication of AD is posterior reversible encephalopathy syndrome (PRES). PRES is a neurotoxic state presenting with rapid onset of symptoms including headache, seizures, confusion, and visual disturbances. Approximately 70-80% of individuals with PRES are hypertensive. These clinical findings are coupled with unique imaging appearances most

commonly affecting the parietal and occipital lobes. Although the pathogenesis is unclear, it is believed to be associated with disordered cerebral autoregulation and endothelial dysfunction which can stem from a variety of mechanisms. Mainstay of treatment includes prompt recognition, blood pressure control, and antiepileptics.
Case diagnosis: Posterior reversible encephalopathy syndrome due to autonomic dysreflexia in C4 AIS A spinal cord injury (SCI).
Participants/methods: 26-year-old male with C4 AIS A tetraplegia after sustaining a teardrop fracture of C5 with retropulsion into the spinal canal and facet fractures of C6 during a diving injury. He underwent emergent decompression and stabilization. He was admitted to acute inpatient rehabilitation and eventually had a suprapubic tube (SPT) placed. 1 month after placement, the patient was noted with poor SPT outflow. He became unresponsive with seizures. He developed AD with elevated blood pressures. MRI revealed T2 hyperintensity within the right medial precentral, postcentral gyrus, left frontal lobe, and left occipital lobe. Cultures revealed E.coli bacteremia. He was diagnosed with posterior reversible encephalopathy due to hypertension from autonomic dysreflexia in the setting of urosepsis. He was treated with antibiotics and maintained on antiepileptics for 3 months. Repeat MRI demonstrated resolution of signal alteration. He was safely discharged home.
Conclusion: Posterior reversible encephalopathy syndrome is a rare complication of autonomic dysreflexia. This case highlights the importance of having a high index of suspicion for PRES when neurological changes are associated with AD.

P27 Prediction of carotid artery intima-media thickness in person with spinal cord injury

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Objective: To develop a prediction equation for carotid artery intima-media thickness (cIMT) in persons with SCI using clinical markers for lipid [high density lipoprotein cholesterol (HDL-C) and triglycerides (TG)], carbohydrate metabolism [fasting plasma glucose (FPG), fasting plasma insulin (FPI)] and inflammation [glycan N-acetylglucosamine (Glyc-A) and high-sensitivity C-reactive protein (hsCRP)].
Background: Cardiovascular disease (CVD) is more prevalent in persons with spinal cord injury (SCI) than in the general population. Cardiometabolic disorders and an increase in systemic inflammatory burden have been shown to be associated with increased cIMT, which is a potent clinical marker of CVD.
Design: A prospective observational study was performed in outpatients with chronic SCI (>1 year).
Participants/methods: Carotid ultrasound and fasting blood samples were determined in 61 male subjects with SCI [35 with paraplegia (PARA) and 26 with tetraplegia (TETRA)]. Calculation of cIMT thickness was performed with a program to analyze cIMT on still images obtained during the sonographic study. The software provided an integrated area of cIMT along the length of the far wall where the border was automatically recognized by identifying the distance between the lumen intima-media interface. Multiple regression models were performed to determine the best predictive variables for cIMT from serum HDL-C, TG, FPG, FPI, Glyc-A, and hsCRP.
Results: The a priori comparison for cIMT values between the TETRA and PARA groups failed to reach significance (0.80 ± 0.36 vs. 0.64 ± 0.24, respectively; P = NS) and, as such, the groups were combined to predict cIMT in the statistical modeling. The best predictor variables that remained in the model to generate the final equation were: cIMT = 0.015(FPG) -0.009(HDL) – 0.110; r2 = 0.40, $P < 0.05$. Each of the individual predictor variables had unique significant contributions to the model (FPG: partial r= 0.56, $P < 0.01$; HDL: partial r= -0.42, P = 0.05); all other variables were removed from the model.

Conclusion: Our findings suggest that standard lipid and inflammatory biomarkers may be used to predict cIMT, information that can be applied clinically to identify potential carotid atherosclerotic burden in persons with chronic SCI.
Support: Department of Veterans Affairs, Veterans Health Administration, Rehabilitation Research and Development Service National Center for the Medical Consequences of Spinal Cord Injury (#B9212-Cand#B2020-C)

P28 Raising awareness for autonomic dysreflexia in the general medical practice

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Objective: To highlight the need for education of general practitioners about the real dangers of autonomic dysreflexia (AD) and empower high-risk individuals to advocate for their care.
Background: AD is a life-threatening complication that people with tetraplegia are at high risk of developing. The constellation of symptoms includes high blood pressure above the injury accompanied by parasympathetic response that is often missed or misdiagnosed by general practitioners.
Design: Case report.
Findings: A 29-yo male with chronic traumatic complete C4 tetraplegia presented to the emergency room with fever, chills, emesis after a Foley change. He was noted to have hematuria and was admitted for a urinary tract infection and possible C. difficile colitis. While in hospital, a rapid response was called due to hypertension 204/125 with headache and the patient "not feeling well". As needed clonidine was ordered by the internist with temporary blood pressure improvement. Another rapid response was called when hypertension returned. Work up revealed elevated troponins and Q waves in AVF on EKG, with heparin drip ordered. He was transferred to the ICU. The goal was to keep systolic blood pressure (SBP) ~180. Patient's blood pressure dropped to SBP 50s after receiving metoprolol, clonidine, morphine, and hydralazine. IV fluids were given. Cardiology was consulted, and diagnosed patient with AD. Ultimately, a CT scan was done showing the Foley catheter was malpositioned with the balloon inflated at the base of the penis. Once the catheter was changed, almost 24 hours later, his labile blood pressure resolved. Patient attempted to educate staff about AD, but was ignored.
Clinical Significance: AD is a very well-described medical entity in people with spinal-cord injuries (SCI) that can be fatal if left untreated or mismanaged. This young patient suffered cardiac damage from troponin leaks due to misdiagnosis and mismanagement of AD. Proactive identification of this knowledge gap is critical so that education can be given and patient harm can be avoided. This case serves as an example of the need to advocate for our patients and educate general practitioners. Education can start with the SCI practitioner at local hospitals.
Conclusion: Lack of awareness and inability to identify AD by general practitioners might put a patient's life at risk. Need for action from both rehabilitation doctors and SCI patients for a coordinated effort to increase awareness regarding AD is required.

P29 Rehabilitation outcomes in middle-age male with herpes zoster myelitis

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Objective: To make SCI clinicians aware of varicella zoster virus (VZV) myelitis
Design: Retrospective observational study
Participant: 40-year-old man
Results: A patient with no significant past medical history presented to an outside hospital for right leg weakness one week after developing a shingles rash on his left flank. On exam, he was found to have right lower extremity weakness and decreased temperature sensation, along with urinary retention. MRI of the spine showed multifocal areas of increasing intensity in the thoracic spinal cord suggestive of myelitis. He was started on IV ganciclovir and steroids, and was transferred to a freestanding, acute comprehensive inpatient rehabilitation facility to treat his gait abnormality. On admission, he was found to have profound weakness in all muscle groups of his right lower limb, decreased sensation to pinprick and temperature in the left lower extremity, bilateral Babinski signs, and decreased sensation to pinprick in the left S3-S5 dermatomes. Vibration sensation was intact bilaterally along with deep anal sensation and voluntary anal contraction. He underwent rigorous inpatient physical and occupational therapy for two weeks. During this time, he regained strength in his right lower extremity, had return of normal bowel and bladder function, and made sufficient functional gains to be able to be discharged to home. After two months of attending outpatient physical therapy following discharge, the patient was able to ambulate independently, but continued to use a cane for longer distances due to fatigue. Myelitis is a rare complication of the varicella zoster virus. It often presents within one to two weeks of the zoster rash, but may occur in the absence of dermatologic findings. Patients commonly present with weakness and numbness, as well as sphincter dysfunction. MRI findings include hyperintensities on T2 imaging, but there has been a report of one case of zoster myelitis with negative MRI findings. It more commonly occurs in immunocompromised or elderly individuals. However, there have been several cases of younger, immunocompetent individuals reported in the literature. In many of these instances, patients achieve dramatic improvement in weakness and function, as seen in this case, with some even making complete recovery within several weeks.
Conclusion: Myelitis is a rare complication of herpes zoster infection. Young, immunocompetent patients typically have complete to near complete recoveries.

P30 Representativeness of the Spinal Cord Injury model systems National Database

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Objective: To assess the representativeness of the Spinal Cord Injury Model Systems National Database (SCIMS-NDB) of all adults aged 18 years or older receiving inpatient rehabilitation in the United States (US) for new onset traumatic spinal cord injury (TSCI).
Design: Secondary analysis of prospectively collected observational data. Setting: Inpatient rehabilitation centers in the US.
Participants/methods: We compared demographic, functional status, and injury characteristics (9 categorical variables comprised of 46 categories and 2 continuous variables) between the SCIMS-NDB (N = 5,969) and UDS-PRO®/eRehabData (N = 99,142) cases discharged from inpatient rehabilitation in 2000-2010.
Results: There are negligible differences (< 5%) between SCIMS-NDB patients and the population for 31 of the 48 comparisons. Minor differences (5-10%) exist for age categories, sex, race/ethnicity, marital status, FIM® Motor score, and time from injury to rehabilitation admission. Important differences (>10%) exist in mean age and pre-injury occupational status; the SCIMS-NDB sample was younger and included a higher percentage of individuals who were employed (62.7% vs. 41.7%) and fewer who were retired (10.2% vs. 36.1%).
Conclusion: Adults in the SCIMS-NDB are largely representative of the population of adults receiving inpatient rehabilitation for new onset TSCI in the US. However, users of the SCIMS-NDB may need to adjust statistically for differences in age and pre-injury occupational status to improve generalizability of findings.
Support: NIDILRR

P31 Seminal vesicle abscess: A rare complication of clean intermittent catheterization

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Objective: To report a rare complication of clean intermittent catheterization (CIC) for management of neurogenic bladder.
Design: Case report
Findings: A 90-year-old male patient with thoracic level 5 ASIA Impairment Scale D paraplegia developed a seminal vesicle abscess after transitioning to a clean intermittent catheterization (CIC) program for management of neurogenic bladder. To our knowledge, there have been no prior reported cases of seminal vesicle abscesses in a patient with spinal cord injury (SCI) using CIC. CIC is a common method of bladder management in spinal cord injury patients. Complications associated with CIC can include urinary tract infection (UTI); urethral trauma, including creation of a false passage; epididymitis; and bladder stones. Seminal vesicle abscesses have been reported in the literature as a complication of indwelling Foley catheter, but there are no known reported cases from CIC. After starting CIC, this patient had two occurrences of urethral trauma causing pain and hematuria. He developed fever, chills, malaise, and altered mental status, and had laboratory results showing leukocytosis and positive urinalysis. Urine culture grew multidrug-resistant Escherichia coli. After he did not respond to antibiotics for UTI, he underwent a computerized tomography (CT) scan of the abdomen and pelvis, which showed a 3.5×2.3 centimeter abscess at the left seminal vesicle. It was thought that the abscess may have developed because of his urethral trauma, creating a false passage to the soft tissue surrounding the seminal vesicle. None of the SCI, infectious disease, or urology providers had seen a prior case of seminal vesicle abscess. After a multidisciplinary discussion, the patient had an attempted ultrasound-guided transrectal aspiration of the abscess, though the fluid was too viscous to aspirate. Ultimately, a follow up CT after 7 weeks of intravenous antibiotics (ertapenem) demonstrated resolution of the abscess. The patient subsequently used an indwelling Foley catheter to manage his neurogenic bladder.
Conclusion: Seminal vesicle abscess is a rare complication of CIC. Seminal vesicle abscesses can be diagnosed with transrectal ultrasonography or with CT scan of the abdomen and pelvis, with contrast. They may be treated with intravenous antibiotics and/or transrectal aspiration with ultrasound guidance. SCI providers should be aware of a seminal vesicle abscess as a rare infectious complication of CIC in managing neurogenic bladder. Multidisciplinary care can help prevent and treat traumatic and infectious complications of CIC.

P32 Sexuality and intimacy: Lack of educational resources for females with Spinal Cord Injury

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Background: To describe the impact a spinal cord injury (SCI) can have on intimacy and sexuality with females. Grounded in the International Classification of Functioning, Disability, and Health (ICF) this study focuses on sexual health as an important aspect of life participation. Participation refers to one's engagement in his/her life including social relationships and family.
Design: This study employed semi-structured interviews.
Participants/methods: A phenomenological approach was used to investigate participant's experience with intimacy and sexuality post acquisition of the SCI. The process includes thematic reduction of the data into

themes and understanding the relationship among the themes. A convenience sample of 10 females with a SCI were recruited for this study from a local rehabilitation hospital who met the criteria for the study. The semi-structured interviews were completed by the research team who were trained by the principal investigator. The interview started with general open-ended questions with probing questions to provide clarification and elaboration on answers provided by the participants. Data were transcribed verbatim and then went through the phenomenological analysis that included extracting significant statements and organizing these into themes.
Results: The participants spoke candidly about their experiences regarding intimacy and sexuality post SCI. Themes were identified related to the need for adequate educational information about the physical aspects of intimacy and sexuality. Educational information on intimacy and sexuality was sometimes described as provided in rehabilitation hospitals, however such materials were perceived as focused on male patients, untimely, and lacking follow-up care post rehabilitation. Additionally, participants identified a need for educational materials for partners of individuals with SCI. The physical aspects of sex discussed included the changing meaning of orgasm, bladder and/or bowel concerns as a sexual deterrent, the physical orgasm as painful, and the feeling of being disconnected from one's genitals post-injury.
Conclusion: The results expose the impact that living with a SCI has on intimacy and sexuality within the female population. The lack of resources available for the SCI population further impedes their ability to fully participate in life. Thus, prescribing the need for fundamental information on intimacy and sexuality for females during the rehabilitation process post discharge.

P33 Spinal cord manifestations in patients with undiagnosed joint hypermobility syndrome

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Objective: Presentation of a retrospective chart review of 3 patients with previously undiagnosed Joint Hypermobility Syndrome (JHS) presenting to our center with spinal cord manifestations.
Design: A case series describing 3 patients with JHS with spinal cord injury (SCI). A retrospective chart review was completed, evaluating their clinical presentation, functional outcomes and challenges encountered specific to their JHS during their rehabilitation.
Participants/Methods: A chart review was completed. Two individuals presented with spinal cord ischemia while the third individual presented with a tethered spinal cord. A review of the literature was conducted to investigate the clinical presentations of joint hypermobility, including documented case reports of spinal involvement, current practices in rehabilitation management and functional outcomes in this population. This review showed a paucity of information, with no case reports identified, regarding spinal cord injury in patients with JHS.
Results: The diagnosis of JHS was based on the following criteria: a Beighton score of 9/9 as well as 2 or more minor criteria including joint subluxation, arthralgia and skin extensibility. Two of these individuals presented with SCI related to spinal hyperextension during dance practice. One patient developed incomplete tetraplegia while the other had complete paraplegia. The third had incomplete paraplegia due to a tethered spinal cord with progressive impairment of gait, and bowel and bladder function. All 3 participated in aggressive activity based restorative therapy (ABRT) to address impairments and functional limitations stemming from their paralysis. Given the increased risk of musculoskeletal complications, modifications were made to their therapy protocols to provide joint protection, joint stabilization and to decrease the risk of injury.
Conclusion: Clinicians should be cognizant that patients with JHS can develop spinal manifestations. They are at increased risk for joint subluxation and overuse injury of affected joints, scoliosis, bowel and bladder issues, pain, and skin breakdown. ABRT must incorporate principles of JHS and SCI rehabilitation. Emphasis should be placed on core and joint stabilization, and protection from repetitive motion injury. Bracing may be needed to prevent overstretching at joints. A custom ultralight weight wheelchair with appropriate trunk support. Power assisted mobility may be necessary.

P34 Unusual case of severe disseminated osteomyelitis in a spinal cord injured patient

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Objective: To describe the clinical complications that developed after seemingly benign urologic infection.
Design: Case report of a 49-year-old man with paraplegia who presented to the emergency department requesting alcohol detoxification, and subsequently found to have fulminant urosepsis.
Background: Disseminated fulminant infection is common in elderly and immunocompromised individuals. It is rare in young and otherwise healthy individuals.
Case description: This is a case report of a T9 AIS A male whose bladder was managed with intermittent catheterization program. Few days prior to admission he was involved in large amounts of alcohol consumption leading him to have poor self-care including bladder over distension. He was seen at his local hospital 3 days prior and was placed an indwelling catheter. He was initially admitted to medical service for treatment of urinary tract infection and alcohol detoxification. His hospital course was complicated with development of electrolyte abnormalities, unexplained drop in oxygen saturation and hallucinations. He was transferred to medical intensive care unit for further management. His blood and urine cultures grew Escherichia coli. During the course he developed severe back and shoulder pain. Imaging during his hospital stay was consistent with a fluid collection anterior to the left sternoclavicular joint, large left shoulder joint effusion, multifocal areas of cortical irregularity and intramedullary lucencies concerning for osteomyelitis in the left sternal –manubrium area extending to the right side. Also had findings indicative of discitis osteomyelitis in the cervical spine at C4-C5 and C6-C7 as well as thoracic T2-T3 and T6-T7 areas. He also was noted to have linear abnormal enhancement in the ventral epidural space at T6-T7 as well as T2 hyperintensity and enhancement in the prevertebral soft tissues at T6-T7. Also noted right femoral acetabular septic arthritis and osteomyelitis and Right iliopsoas bursitis. He underwent left shoulder open Irrigation and debridement, debridement of left sternoclavicular joint and right iliacus muscle drain placement.
Results: Urosepsis resulted in numerous infectious complications in this 49-year-old man with paraplegia. After lengthy treatment with appropriate antibiotics and surgical interventions, he was discharged home in stable condition.

P35 Validating an algorithm to identify non-traumatic spinal cord dysfunction

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Objective: To validate an algorithm for identifying non-traumatic spinal cord dysfunction (NTSCD) using health administrative databases through a chart review.
Background: With the rising prevalence of NTSCD, there is a need to identify these patients in administrative databases for epidemiology and system performance monitoring. Given the diverse etiologies of NTSCD and varying times of diagnoses, this population is challenging to identify in health administrative data. To advance knowledge in this field, our research group created an algorithm to identify patients with NTSCD in hospital discharge abstracts. The purpose of the current study was to validate the developed algorithm using chart data as the gold standard.
Design: Validation of algorithm using chart review.
Participants/methods: The algorithm developed by our research team was applied to health records at both acute care and inpatient rehabilitation facilities in Edmonton, Canada. Chart reviews were conducted to

confirm the NTSCD or traumatic spinal cord injury (TSCI) diagnoses using a standardized abstraction form. Measures of diagnostic accuracy including sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) along with 95% confidence intervals (CI) were computed.
Results: The algorithm identified 274 charts as NTSCD, of which 231 were confirmed to be NTSCD by chart review. Thirty-eight charts were identified as TSCI, and 35 of these were confirmed to be true TSCI cases. These results yielded a sensitivity of 98% (95% CI, 96%-99%), specificity of 45% (95% CI, 34%-57%), PPV of 84% (95% CI 79% to 88%), and NPV of 92% (95% CI, 79%-98%).
Conclusion: The algorithm was found to have high sensitivity, PPV, and NPV. The relatively low specificity may reflect a need to explore how NTSCD is documented and coded in health records and how the algorithm distinguishes conditions that lead to NTSCD. Further refinement of the NTSCD algorithm may involve consensus meeting with key stakeholders and clinical experts.
Support: Brain Canada Platform Support Grant

P36 Wheelchair rugby performance and training

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Design: The design for this study is an observational study approach. A prospective longitudinal cohort design will allow for demographic, characteristic, participation, and outcome measure collection for a group of wheelchair rugby athletes, specifically the Columbus wheelchair rugby team. A cohort study design is optimal to determine the prevalence, incidence, and important factors related to shoulder pain in wheelchair rugby athletes.
Participants/methods: Participants include wheelchair rugby athletes. This research study will be conducted over the course of multiple seasons. Corresponding demographic information and wheelchair rugby classification score have been collected with plans for continued data collection. Two main clinical assessments with specific scoring guidelines were utilized to measure and assess functional ability and shoulder pain: Wheelchair User's Shoulder Pain Index and Disability of the Arm, Shoulder, and Hand. These assessments are clinically relevant, evidence-based, and used readily in clinical practice. Descriptive statistics are used to summarize collected data. Data analysis focuses on demographic information, disability classification, experience with wheelchair sports, and wheelchair rugby participation in the context of shoulder overuse injury and pain.
Results: With data collected over multiple seasons, study investigators better able to assess meaningful changes among individual athletes and as a group from season to season. All participants were male with age range 21 to 46 years old. The athletes were individuals with cervical spinal cord injuries or cerebral palsy. Wheelchair rugby classification scores ranged from 0.5 to 3.0. The average overall DASH score was 32.10. Based on normative DASH data, six participants' overall scores, one participant's work scores, and four participants' sports scores fell outside one standard deviation from the mean. The average WUSPI score for continuous scores was 22.6. Nine participants' WUSPI scores were greater than 1.0, which indicates self-report of shoulder pain, and four participants' WUSPI scores were greater than 20.0.
Conclusion: This collection study is designed to examine shoulder pain specifically among wheelchair rugby athletes and, as these data serve as preliminary research findings for the larger study, the presented demographic and disability information provides an initial snapshot of the wheelchair rugby team and individual athlete.